Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/CA05/000175

International filing date: 11 February 2005 (11.02.2005)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/543,327
Filing date: 11 February 2004 (11.02.2004)

Date of receipt at the International Bureau: 27 April 2005 (27.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

PCT/CA 20050000175

PA 1292828

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APPLICATION NUMBER: ***60/543,327***
FILING DATE: ***February 11, 2004***

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No.

INVENTOR(S)

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☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

METHOD AND APPARATUS FOR CATALOGUING AND DELIMITING MOVEMENT IN AN ENVIRONMENT FOR PURPOSES OF TRACKING AND/OR CONTAINMENT OF INFECTIOUS DISEASES

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15335 U.S.PTO 60/543327 021104

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 28 ☐ CD(s), Number

☒ Drawing(s) *Number of Sheets* 9 ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☒ Applicant claims small entity status. See 37 CFR 1.27.

☒ A check or money order is enclosed to cover the filing fees

FILING FEE AMOUNT ($): 80.00

☐ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:

☐ Payment by credit card. Form PTO-2038 is attached.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted

SIGNATURE _____ Date 2/11/2004

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TELEPHONE 703-668-8000 Docket Number: 23390-000122/US

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C., 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Title: **METHOD AND APPARATUS FOR CATALOGUING AND DELIMITING MOVEMENT IN AN ENVIRONMENT FOR PURPOSES OF TRACKING AND/OR CONTAINMENT OF INFECTIOUS DISEASES**

FIELD OF THE INVENTION

[0001] The present invention relates to a method and apparatus for tracking and delimiting the movement of people and equipment and articles in a defined environment for the purposes of containment of infectious diseases and other contagion.

BACKGROUND OF THE INVENTION

[0002] Recent outbreaks of critically dangerous and acute infectious diseases have demonstrated how rapidly diseases can be spread before health authorities and other governmental agencies are able to identify and establish an outbreak state. Once an outbreak has occurred, containment becomes a priority and typically involves tracking the infected individuals back to the source.

[0003] As illustrated by the SARS outbreak, identifying individuals who have been exposed to the infectious virus or disease and then tracking the exposure of these individuals become the critical criteria in containing the further spread of the disease.

[0004] Accordingly, there remains a need for a system and procedures for tracking and delimiting movement of people and equipment in a defined environment in order to quickly contain infectious diseases.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention provides a method and apparatus for tracking, cataloguing and/or delimiting movement in an environment for the purposes of containing infectious diseases or other contagion.

[0006] According to one aspect, the present invention provides a process for cataloguing and delimiting movement of patients, medical staff, employees, visitors, medical equipment, medicine trolleys, food trolleys, medical gases, laundry hampers, and other equipment or personnel in a healthcare environment, for example, a hospital, a medical center, or a smaller facility, such as a clinic or a doctor's office. In accordance with this aspect, tracking mechanisms are provided for tracking, cataloguing and delimiting the movement within the environment.

[0007] According to another aspect, the tracking, cataloguing and delimiting procedure operates on two levels. The first level comprises operation during normal conditions in a healthcare facility, for example, a hospital or a doctors' clinic. The second level comprises operation during an outbreak of an infectious disease or a contagious state.

[0010] The system comprises electronic tagging components and tracking components. The electronic tagging components are coupled or affixed to personnel in the facility on entering the facility and also to medical equipment and other apparatus which may be moved around the facility or into or out of the facility.

[0011] During normal conditions, the system operates at a first level to allow normal procedures to subsist for patients, hospital medical staff, visiting medical staff, visitors, general public entering the facility and contractors visiting or working in the facility. Operation at this level allows movement of personnel and

equipment and apparatus to be observed and recorded. Information regarding the recorded movement is available for archive for future reference.

[0012] During an infectious outbreak or other alert state, the system operates at a second level with immediate access to recorded data and newly collected information on movement of personnel and equipment into and throughout the facility in order to facilitate or assist in tracking and containing potential carriers of the infectious contagion.

[0013] In one embodiment, the present invention provides a system for providing containment of an infectious disease in a facility, the system comprises: one or more of scrutinizers, each of the scrutinizers includes a receiver for receiving an identification signal, and further includes an output module for outputting a signal in response to the identification signal being received; one or more identification tags, one of the identification tags being worn by each person having entry in the facility, and each of the identification tags including a transmitter for transmitting the identification signal associated with the person wearing the respective identification tag; the scrutinizers being located throughout the facility including an entrance scrutinizer, an exit scrutinizer, and one or more passageway scrutinizers; a controller, the controller having an input port for receiving the output signals generated by each of the scrutinizers, and further including a processing module, the processing module having a sub-module for creating a record for each of the persons having entry in the facility, the record including temporal information from one or more of the scrutinizers having detected the identification signal associated with the person.

[0014] In another embodiment, the present invention provides a method for tracking potential carriers of an infectious disease in a facility, the method comprises the steps of: assigning a unique identifier to each individual having access to the facility, and providing each of the individuals with a transmitter for

transmitting the assigned unique identifier; detecting transmission of the unique identifiers for the individuals at one or more locations in the facility based on movement of the individuals; establishing a record for each the individuals, each of the records including temporal data indicating time and date for detection of the unique identifier for the associated individual; storing the records and making the records available for retrieval; identifying one or more of the individuals as the potential carriers; retrieving the records associated with each of the identified individuals; establishing an area of movement for each of the identified individuals, the area of movement being based on the temporal data and the locations in the facility where the unique identifier was detected.

[0015] In yet another embodiment, the present invention provides a system for tracking the movement of persons in a facility as potential carriers of an infectious virus or disease, the system comprises: one or more receivers, each of the receivers having an input for receiving an identification signal, each of the persons in the facility having an associated identification signal, and each of the receivers including an output for outputting an output signal for each of the identification signals; one or more transmitters, each of the persons wearing one of the transmitters, and each of the transmitters transmitting the identification signal associated with the person; the receivers being located throughout the facility; a controller having an input port for receiving the output signals, and including a component for generating a temporal record for each of the persons in response to the detection of the identification signal of the person by one or more of the receivers.

[0001] Other aspects and functions of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Reference will now be made, by way of example, to the following drawings which show, by way of example, embodiments of the present invention, and which:

[0017] Fig. 1 is a schematic diagram showing an exemplary healthcare facility configured with a system for tracking and scrutinizing movement scrutinizer and a cataloguing mechanism in accordance with the present invention;

[0018] Fig. 2 shows in flow-chart form a procedure for cataloguing and delimiting movement of personnel and apparatus in a healthcare facility during normal conditions;

[0019] Fig. 3 shows in flow-chart form a procedure for cataloguing and delimiting movement of personnel and apparatus in a healthcare facility during an outbreak state;

[0020] Fig. 4 shows an access and security scrutinizer for the facility of Figs. 2 and 3;

[0021] Fig. 5 shows a traffic movement tracking and scrutinizing mechanism for access points in the facility of Figs. 2 and 3;

[0022] Fig. 6 shows another aspect of a traffic movement mechanism for corridors and other passage ways in the facility of Figs. 2 and 3;

[0023] Fig. 7 shows a traffic movement mechanism suitable for tracking movement through an emergency exit in the facility of Figs. 2 and 3;

[0024] Fig. 8 shows a configuration of sub-network communication components for various entrance and exit points in a facility;

[0025] Fig. 9 shows a communication module for a wireless local area network implementation for a facility in accordance with the present invention; and

[0026] Fig. 10 shows a transmission process for the wireless local area network of Fig. 9.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0027] Reference is first made to Fig. 1, which shows in diagrammatic form a healthcare facility configured with a system 10 according to the present invention. The healthcare facility denoted generally by reference 1 comprises a hospital, medical centre, doctors' clinic or other similar type of building or complex. While the present invention is described in the context of a multi-floor healthcare facility, it is to be appreciated that the system is equally applicable to larger complexes, or to smaller buildings, for example, a walk-in health clinic or a doctor's office.

[0028] While the system 10 and processes according to the present invention are described in the context of hospitals, and medical facilities in general, it is to be appreciated that the present invention has wider applicability to passenger terminals, such as airports, train terminals and bus depots; public meeting or gathering places, such as shopping malls, cinemas, theatres and hotels; governmental facilities, such as military headquarters, military bases, military research facilities, government offices; prisons; schools and universities; theme parks; and shipping vessels. In addition, the system 10 is suitably configurable, for example via a wide area network, to a complex with multiple buildings or

sites, for example, hospitals belonging to a healthcare network, or military hospitals or healthcare facilities for the armed forces or a division of the forces. The wide area network may be based on a private or proprietary architecture, or a public or open source architecture, such as the Internet, for example, operating with an encrypted or secure layer or layers.

[0029] As shown in Fig. 1, a system for tracking, cataloguing and delimiting movement of personnel and apparatus 10 in a healthcare facility 1 comprises a number of tracking stations 20, a network 30, and a control module 40. The tracking stations 20 are indicated individually by references 20a, 20b, 20c, 20d and 20e. Each of the tracking stations 20 is installed at an entrance point 12, and exit point 14, or a traffic or movement corridor or passage 16 in the healthcare facility 1 or other traffic or movement scrutinizing location. As shown in Fig. 1, the tracking system 20a is configured for the entrance point 12 (for example, the front door or main entrance and reception area), the tracking station 20b is installed for the exit 14 (for example, the emergency exit), the tracking station 20c is installed in a first floor passage corridor 16a, the tracking station 16b is installed in a second floor passage corridor 16b, and the tracking station 16c is installed for an upper floor passage corridor 16c. The tracking stations 20 each include a network component 22, indicated individually as 22a, 22b and 22c in Fig. 1. The network components 22 are coupled together to form the network 30. As will be described in more detail below, the network 30 comprises a (wireless) local area network 100 (Fig. 8) or LAN, a wide area network or WAN, or the Internet. The network 30 may be based on a generally available architecture or a proprietary architecture.

[0030] The tracking stations 20 are configured in the entrance way 12, the exit point 12 and in the corridors 16. In a typical healthcare facility 1, the corridors 16 for installing the tracking stations 20 are selected based on a number of factors, including: amount of traffic (e.g. high traffic passages), special purpose

corridors (e.g. emergency room), function specific areas (e.g. intensive care unit, surgery, medicine dispensary, food services, laundry services, heating and cooling control), maintenance corridors or passage ways, restricted access passage ways, or passage ways leading to construction areas. The network capability of the tracking stations 20 allows additional stations 20 to be installed and/or the system 10 to be reconfigured or rearranged according to physical or traffic pattern changes in the facility 1.

[0031] Reference is next made to Fig. 2 which shows in flow-chart form a cataloguing and delimiting procedure in accordance with the present invention and indicated generally by reference 200. The cataloguing and delimiting procedure 200 is configured for the healthcare facility 1 operating under normal conditions or in healthful times i.e. without a contagious disease outbreak or infectious condition. According to this aspect, the system 10 continues to perform monitoring and recording or cataloguing functions because an outbreak is not usually predictable. In the event of an infectious disease outbreak or contagious condition, the system 10 changes in operation to a high scrutiny level as will be described in more detail below and also with reference to Fig. 3. Data collected or catalogued during healthful times is made available in order to assist in tracing or establishing possible conditions or states leading to the outbreak.

[0032] As shown in Fig. 2, the cataloguing and delimiting procedure 200 comprises a scrutinization operation indicated by reference 202. Personnel attending the facility 1 include medical staff, patients, visitors and may also include contractors. The personnel are indicated generally by reference 201. The scrutinization operation 202 is performed in the main entrance corridor or reception area 12, and comprises scrutinizing personnel entering or attending the facility 1. Personnel 201 are differentiated as regular, and as unusual, and with electronic tags. Regular personnel with electronic tags are allowed into the facility 1 as indicated by 204. Unusual or non-typical personnel are subjected to further

scrutiny as indicated by 206. As indicated by 208, the unusual personnel are allocated an identification number, which may comprise their social insurance number (SIN) or their social security number (SSN) or other identifier which is unique to a person. (According to another aspect, a RFID tag may be encapulated into the SIN or SSN identifier or card.) The identifier is used to retrieve information from a database to determine if the person has been exposed to a disease or is suffering a condition which would necessitate limiting or preventing access to the facility 1. Next a decision is made in block 210 to determine if electronic tagging is allowed. If allowed, a temporary electronic tag is affixed to the personnel 212. This may be followed by an interview stage as indicated by reference 214. If electronic tagging is not allowed (as determined in step 210), then the personnel are subjected to an interview in step 216. If it is determined that the subject personnel has been exposed to an infectious disease, is exhibiting symptoms of a disease or infection or should otherwise be observed, then the personnel is not issued a temporary electronic tag and directed to quarantine for medical observation or attention as indicated by reference 218. Following the interview stage 214, affixing of a temporary electronic tag 222 or entry as regular personnel with an electronic tag 204, another screening step is performed in step 224. If the screened personnel are clear to enter based on interrogation of the affixed electronic tag or temporary electronic tag and retrieval of information from the database, then entrance into the facility 1 is permitted in step 226. If the personnel screened in step 224 are not permitted entrance, they are directed to quarantine for further medical observation in step 218.

[0033] Once admitted to the facility 1, personnel with an electronic tag or a temporary electronic tag are tracked using apparatus installed or located throughout the facility 1. As indicated by reference 228, the movement of personnel is tracked and stored in a database 229. Movement of personnel is tracked using monitoring nodes located throughout the facility 1 in corridors and

portals indicated individually as 230a, 230b, 230c, 230d, 230e and 230f. The monitoring nodes 230 (for example, the tracking stations 20 in Fig. 1) are coupled together to form a local area network 232 with the database 229. Records concerning the movement of personnel throughout the facility 1 are generated and stored in the database 229. The database 229 and other monitoring and scrutinizing equipment may be located in a central location in the facility 1, such as the information technology center or security office. The records may also be transmitted, e.g. emailed, to a central health authority.

[0034] Reference is next made to Fig. 3, which shows in flow-chart form a tracking or cataloguing and delimiting procedure for unhealthful times in accordance with the present invention and indicated generally by reference 300. The cataloguing and delimiting procedure 300 is configured for the healthcare facility 1 operating under infectious conditions or unhealthful times i.e. a contagious disease outbreak or infectious condition. According to this aspect, the system 10 performs additional monitoring and scrutinization functions as compared to the tracking or cataloguing and delimiting procedure 200 described above with reference to Fig. 2.

[0035] As shown in Fig. 3, the cataloguing and delimiting procedure for unhealthful times, indicated generally by reference 300, comprises a scrutinization operation indicated by reference 302. As described above, personnel attending the facility 1 include medical staff, patients, visitors and may also include contractors and are indicated generally by reference 301 in Fig. 3. The scrutinization operation 302 is performed in the entrance corridor or reception area 12, and comprises scrutinizing personnel entering or attending the facility 1. Personnel 301 are differentiated as regular, and as unusual, and with electronic tags. As will be described in more detail below, under the procedure 300 for unhealthful times, all personnel and traffic 301, included both regular

electronic tagged traffic 304 and unusual non-electronic tagged traffic 306, are subjected to greater scrutiny.

[0036] Referring to Fig. 3, the unusual or non-typical personnel 306 are subjected to scrutiny as indicated by reference 308. The unusual personnel are allocated an identification number, which may comprise their social insurance number (SIN) or their social security number (SSN) or other identifier which is unique to a person. The identifier is used to retrieve information from a database to determine, for example, if the person has been exposed to a disease or is suffering a condition which would necessitate limiting or preventing access to the facility 1. Next a decision is made in block 310 to determine if electronic tagging is available in a manner similar to that described above with reference to Fig. 2. If available, a temporary electronic tag is affixed to the personnel 306 in block 312. This is followed by an interview stage as indicated by reference 314. If electronic tagging is not available (as determined in step 310), then the personnel are subjected to an interview in step 316. If it is determined that the subject personnel has been exposed to an infectious disease, is exhibiting symptoms of a disease or infection, or should otherwise be observed, then the personnel is not issued a temporary electronic tag and directed to quarantine for medical attention as indicated by reference 318. If the subject personnel pass or complete the interview at 316, then an order for an electronic tag is created in block 320, and a temporary electronic tag is affixed to the subject personnel in block 322.

[0037] Referring to Fig. 3, regular personnel 301 with electronic tags enter the facility 1 at an entrance indicated by 302. At the entrance 302, the electronic tags worn by the regular personnel are scanned by apparatus (as described in more detail below), and based on the scanning operation the personnel are admitted as regular electronic tagged traffic indicated by reference 304. The scanning operation comprises reviewing database records associated with the regular personnel to determine if they present an infection risk, for example, if the

regular personnel have been exposed or if showing symptoms. Database records and other information are retrieved using the unique identifier association. However as compared to the procedure 200 in Fig. 2, the regular electronic tagged personnel 304 are subjected to further scrutiny indicated by reference 305. During unhealthful times, the regular tagged personnel 304 are subjected to an interview as indicated by reference 314. The further scrutiny 305 may also comprise travel interview scrutiny. As shown in Fig. 3, a domestic interview stage 307 and an overseas or international travel interview stage 309 are provided. The domestic interview stage 307 provides screening and information collection for personnel who have travelled domestically, but may have been exposed. The overseas travel interview stage 309 provides screening and data for personnel who have travelled internationally or overseas. The purpose of the interview stages 307 and 309 is determine if the personnel have been exposed or infected as a result of their travel. The collected information and data are stored in the database and may be used to establish and/or track a breakout or exposure history for a contagious disease or virus. For example, one or more of the regular personnel 304 may have been subjected to an infectious disease or contagion while travelling and according to this aspect, it is desirable to detect or screen such personnel 304. Information or data collected during the interview 314 or travel interview 305 is stored in the database, and archived and/or compiled for subsequent screening and decision making.

[0038] Following the interview stage 314, affixing of a temporary electronic tag 322 or interview 314 or travel interview 305 as regular personnel 304 with an electronic tag, another screening step is performed in step 324. If the screened personnel are clear to enter based on interrogation of the affixed electronic tag or temporary electronic tag and on scrutiny of information retrieved from the database, then entrance into the facility 1 is permitted in step 326. If the personnel screened in step 324 are not permitted entrance, they are directed to quarantine for further medical observation or attention in step 318. Once

admitted to the healthcare facility 1, personnel with an electronic tag 304 or personnel 306 with a temporary electronic tag are tracked using apparatus (i.e. the tracking and scrutinizing stations 20 in Fig. 1) installed or located throughout the facility 1. As indicated by reference 228, the movement of personnel 304, 306 is tracked and stored in a database 229. Movement of personnel is tracked using monitoring nodes located throughout the facility 1 in corridors and portals indicated individually as 230a, 230b, 230c, 230d, 230e and 230f. The monitoring nodes 230 are coupled together to form a local area network 232 with the database 229. Records concerning the movement of personnel 304, 306 throughout the facility 1 are generated and stored in the database 229. The database 229 and other monitoring equipment may be located in a central location in the facility 1, such as the security office.

[0039] Reference is next made to Fig. 4, which shows in diagrammatic form an embodiment of an access and security scrutinizer 400 for the facility 1 according to another aspect of the present invention. The access and security scrutinizer 400 is installed at the main entrance point 12 (Fig. 1) for the facility 1. As shown in Fig. 4, the access and security scrutinizer 400 comprises a computer station 402 and a scanning antenna 404 (depicted as a broken line). The scanning antenna 404 is installed or configured around a doorway or portal 406 which leads to the interior of the healthcare facility 1. In one embodiment, the scanning antenna 404 takes the form of a RF (radio frequency) passive antenna. The RF passive antenna 404 is arranged around the perimeter of the doorway 406. The RF passive antenna 404 is compatible with RFID (radio frequency identifier) tags, which take the form of, or are incorporated as a component of, an electronic tag 410 or a temporary electronic tag 412. For example in Fig. 4, a visitor 414 (i.e. unusual non-electronic tagged personnel 306) wears a temporary electronic tag 412, and a member of medical staff 416 wears an electronic tag 410. When personal pass through the doorway 406, the identification signal emitted by the RFID tag 410 or 412 is picked up by the RF passive antenna 404,

and the antenna 404 generates an output. The RF passive antenna 404 is coupled to the computer station 402. The computer station 402 executes a computer program which processes the output generated by the RF passive antenna 404 to identify the personnel wearing the electronic tag 410 or 412 based on the identification signal emitted by the RFID unit in the tag. The computer program also retrieves the record from the database associated with the personnel and a determination is made to allow the personnel further access into the facility 1. If the personnel is considered to be infected or a carrier of an infectious disease, then an alarm is initiated at the computer station 402 and the personnel is stopped from entering through the doorway 406. If the personnel is allowed access, then the database record is updated with information, e.g. the date and time the personnel entered the healthcare facility 1, and similar information is collected to track the movements of the personnel through the facility 1, e.g. the hospital, as the personnel passes by the monitoring nodes (i.e. the tracking stations 20 in Fig. 1). In this way, the movements of personnel are recorded and/or catalogued, and the event of exposure to a contagion, an exposure map or perimeter area in the healthcare facility 1 is determined and personnel having been within that area are identified as potential carriers or infected individuals. For example, an exposure zone or area may be created by defining the movements of an infected patient, visitor, or medical equipment, for example. This information is then cross-referenced with the movements of personnel in or through the area of exposure, and these personnel are identified as potential carriers.

[0040] Reference is next made to Fig. 5, which shows in diagrammatic form a traffic movement tracking and scrutinizing arrangement or mechanism in accordance with another aspect of the present invention. The traffic movement tracking mechanism is indicated generally by reference 500 and configured for one of the corridors or hallways 16 in the healthcare facility 1 (Fig. 1). As illustrated in Fig. 5, the traffic movement tracking mechanism 500 provides the

capability to track and catalogue movement through the corridor 16 by a visiting doctor 502, a resident medical staff member 504, a patient 506 and movable medical apparatus 508, with each having an electronic tag 501 attached.

[0041] As shown in Fig. 5, the traffic movement tracking and scrutinizing system 500 configured for the hallway 16 comprises a tracking station 20c and another tracking station 20f. The tracking station 20c is installed at a location 510 in the corridor 16. The other tracking station 20f is installed at a doorway 512 at one end of the hallway 16. As described above, each of the tracking stations 20c and 20f comprise a scanning antenna 520, indicated individually by references 520c and 520f in Fig. 5 (shown in broken outline). The scanning antenna 520c is installed around the perimeter walls 522a and 522b and the ceiling 524 at location 510 in the hallway 16. The type of scanning antenna 520c utilized depends on the type of transmitter devices utilized in the tags 509. According to one embodiment, RFID (Radio Frequency Identification) technology is utilized in the tags 509 and for the scanning antenna 520 as described in more detail below. For example, the scanning antenna 520c may be surface mounted on the walls 522 and the ceiling 524 of the corridor 16 for an existing installation, or mounted in ABS wiring tracks or conduits (not shown) below the surface for a new installation or building construction. Similarly, for the doorway 512, the scanning antenna 520f is mounted along the door jambs 526. Again the type and configuration of the scanning antenna 520f depends on the type of RFID device or transmitter utilized in the electronic tags 509.

[0042] Referring to Fig. 5, each of the tracking stations 20c and 20f also includes a communication module 530, indicated individually as 530c and 530f. The communication modules 530c, 530f correspond to the network components 22 shown in Fig. 1. The communication module 530 includes an antenna interface 532 which is coupled to the scanning antenna 520. The communication module 530 also includes a processor stage 534 and a communication interface

536. The processor stage 534 receives the signal emitted by the tag 509 and coupled by the scanning antenna 520, and processes, i.e. decodes, the received signal. The communication interface 536 couples the communication module 530 to a network 538, for example, a WAN, or the Internet as described in more detail below. Through the network 538, the communication modules 530 are coupled to a central computer or processor and database system, i.e. the control station 40 (Fig. 1). The control station 40 runs software which inputs the received signals from each of the tracking stations 20 and creates a record for each of the visiting doctor 502, the medical staff member 504, the patient 506 and the movable medical apparatus 508 in response to the detection of movement through a tracking station portal 20. The record catalogues the movement of an individual, or mobile or movable equipment throughout the facility 1. The record includes temporal data, e.g. date and time stamp, indicating the times when the person or equipment passed through each portal or was detected by the tracking stations 20. The records are stored in the database system, and made available for further processing. In one aspect, information contained in the records is used to determine an exposure zone or area, and the persons and equipment which moved through that exposure area. The exposure zone is determined by mapping the movement of individuals or equipment exposed to the virus or contagion. The exposure zone may then be used to identify other potentially infected individuals or contaminated mobile equipment based their date and time of presence within the determined zone. In another aspect, the detection of individuals or equipment by the tracking stations 20 is utilized for real-time scrutiny. For example, if mobile equipment 508 is moved without proper clearance or without being sterilized, then detection of the equipment 508 being moved triggers an alarm condition. A similar procedure is implemented for an infected patient or individual moving from their room or beyond a defined zone or area in the healthcare facility 1 (Fig. 1).

[0043] Reference is next made to Fig. 6, which shows in diagrammatic form the corridor 16 configured with tracking stations 20c and 20f as described above with reference to Fig. 5. As shown, a visitor 602 wearing an electronic tag 509 is walking down the passage way and will pass through the tracking station portal 20c. As shown, a hospital worker 604 is also present in the corridor 16 and is moving a mobile medical device 606 down the passageway in the direction of the tracking station 20c. The hospital work 604 carries an electronic tag 509, and an electronic tag 509 is also affixed to the mobile medical device 606. As the visitor 602 passes through the tracking station portal 20c, the scanning antenna 520c (Fig. 5) couples the signal emitted by the transmitter (i.e. RFID) in the tag 509, the received signal is processed and transmitted by the communication module 530c (Fig. 5) via the network 538 (Fig. 5) to the control station 40 (Fig. 1), a record is created or updated to catalogue the movement (i.e. time and date stamp) of the person, and the record is stored in a database, and made available for further processing. Similarly, a record is updated to catalogue the movement of the hospital worker 604 through the tracking station portal 20c. The movement of the mobile medical equipment 606 is also catalogued and the record updated as the hospital worker 604 pushes the equipment 606 through the tracking station portal 20c. The scanning antenna 520c detects the signal transmitted by the RFID in the tag 509 attached to the equipment 606, the signal received from the antenna 520c is processed by the communication module 530c and transmitted to the control station 40 (Fig. 1) via the network 538, and the record is updated and stored in the database by the control station, i.e. computer.

[0044] Reference is next made to Fig. 7, which shows in diagrammatic form a tracking and cataloguing mechanism 700 for the emergency exit 14 of the healthcare facility 1 (Fig. 1) according to another aspect of the invention. The tracking mechanism 700 provides the capability to track and catalogue the movement of individuals 702 wearing an electronic tag 703, and mobile equipment which is tagged (not shown) through the emergency exit 14. There will

be instances where individuals 702 will use the emergency exit 14 instead of the main entrance 12, for example, during an emergency evacuation of the healthcare facility 1 (Fig. 1), or during a security breach. In either situation, it is desirable to track and catalogue movement of the individual 702 and/or medical equipment (not shown) through the emergency exit 14.

[0045] As shown in Fig. 7, the traffic tracking mechanism 700 configured for the emergency exit 14 comprises a tracking station 20b. The tracking station 20b is installed at the doorway 704 for the emergency exit 14. As described above, the tracking station 20b comprises a scanning antenna 720b (shown as a broken line). The scanning antenna 720b is mounted along the door jambs 706 of the doorway 704. As described above, the type and configuration of the scanning antenna 720b depends on the type of RFID device or transmitter utilized in the electronic tags 509. The tracking station 20b includes a communication module 730b and corresponds to the network component 22 shown in Fig. 1. The communication module 730b includes an antenna interface 732 which is coupled to the scanning antenna 720b. The communication module 730b also includes a processor stage 734 and a communication interface 736. The processor stage 734 receives the signal emitted by the tag 703 and coupled by the scanning antenna 720b, and processes, i.e. decodes, the received signal. The communication interface 736 couples the communication module 730b to the network 30 (Fig. 1). As described above, the communication module 730b is coupled to the central computer or processor and database system, i.e. the control station 40 (Fig. 1). The control station 40 runs software which inputs the received signals from the tracking station 20b and updates the record for each individual 702 and/or tagged medical equipment (not shown) which moves through the emergency exit 14. As also described above, the record includes temporal data, e.g. date and time stamp, indicating the times when the person or equipment passed through the emergency exit portal 20b. The records are stored in the database system, and made available for further processing. In situations

where there is a breach of the emergency exit 14, the records may also be used to track the movements of individuals 702.

[0046] Reference is made to Fig. 8, which shows in diagrammatic form detection and communication modules 800 for various passageway, entrance and exit points in the facility 1 according to another aspect of the invention. The detection and communication modules 800 are indicated individually by references 800a, 800b, 800c, and 800d in Fig. 8. The detection and communication module 800a is configured in a corridor 802, for example, similar to the corridor 16b described above. The detection and communication module 800b is shown configured for an elevator portal 804. The detection and communication module 800c is shown configured for a door or entrance way portal 806. The detection and communication module 800d is shown configured for a stairwell or staircase portal 808. Each of the detection and communication modules 800 includes a controller module 810 and a scanning antenna 812. The controller modules 810 are shown individually by references 810a, 810b, 810c, and 810d in Fig. 8. The scanning antennae 812 are shown individually by references 812a, 812b, 812c, and 812d in Fig. 8. The controller modules 810 include an input port 814 for coupling to the scanning antenna 812. The controller modules 810 also include a communication interface 816. The scanning antenna 812 are mounted or affixed to or around the passageway opening or portal. As described above, the type of scanning antenna 812 used depends on the type of communication protocol and devices being utilized, for example, a RFID tag based system as described above, and implemented in accordance with ISO 18000-3/15693 standards.

[0047] In one embodiment, the communication interface 816 comprises a wireless implementation as illustrated in Fig. 8. For example, the communication interface 816 is implemented using the SkyGate™ series communication controller devices available from CStar Technologies Inc. of Toronto, Ontario,

Canada. The communication interface 816 comprises an antenna which transmits and receives over a wireless communication channel or channels which form a wireless local area network or WLAN indicated by reference 820 in Fig. 8. The communication protocol for the WLAN 820 is defined by the communication interface 816 and the controller modules 810 used in the implementation. The WLAN 820 forms a sub-network layer which couples the detection and communication modules 800 to a central scrutinizing and management system. The central scrutinizing and management system is indicated by reference 830 in Fig. 8 and comprises a computer system 832 and a communication interface module 834. The communication interface module 834 may comprise a wireless communication module which interfaces directly with the WLAN 820. In another implementation, the communication interface module 834 includes a sub-network communication module 836. The sub-network communication module 836 provides a gateway between the sub-network WLAN 820 and the communication interface module 834. The sub-network communication module 836 communicates with the communication interface module 834 via a dedicated communication link, or via an Internet link 838. The Internet link 838 may be encrypted or otherwise secured. The Internet link 838 is suitable for multi-floor or multi-site installations. The computer system 832 may include a database server and management system and provides the functionality as described above.

[0048] Reference is next made to Fig. 9, which shows in diagrammatic form a communication controller implemented using a SkyGate™ series device from CStar Technologies Inc. The SkyGate communication controller is indicated generally by reference 900 and comprises a controller board 901, a reader board 902, an antenna Balun board 904, a RFID antenna 906, a RF modem 908, and a power supply 910. The controller board 901 includes one or more microprocessors suitably programmed to provide the required functionality. The RFID antenna 906 is tuned to receive the radio frequency signals emitted by the

electronic tags (for example, the tag 509 in Fig. 5), and the received RFID signal is coupled by the antenna Balun board 904 and converted to a suitable level for the reader board 902. The reader board 902 processes the received RFID signal, for example, decoding the RFID signal, converting the RFID signal into digital format, outputting the digital signal to the controller board 901. The controller board 901 formats the digitized RFID signal into a message or packet which is then transmitted by the RF modem 908 via the WLAN (i.e. the sub-network WLAN 820 in Fig. 8). The operation of the SkyGate communication controller 900 is further illustrated by the flowchart shown in Fig. 10.

[0049] In one embodiment, the tracking tags are implemented using active tag technology, e.g. a TXP or Tag X-Ponder. The Tag X-Ponder comprises a PCT (Packet Coupler Transponder) which includes the power and features of a passive read/write tag operating under protocols such as supported under ISO 18000-3 standard for a proximity of vicinity activation. In addition, the TXP based tracking tag includes a UHF transmission module for sending the identifier, i.e. ID number, associated with the respective tracking tag. The TXP device is active device and includes a local power source, for example a lithium battery or cell, and operates at 3.3 volts or less, and provides a supply current in the microAmpere range. The TXP-based electronic tag remains in a "wait state or sleep mode" and is activated, i.e. "wakes up", in response to an input or trigger initiated by a RFID Interrogator terminal. The interrogator terminals are located or positioned at the tracking stations 20 in the entrance point 12, the exit 14, and the passageway corridors 16 of the facility 1 (Fig. 1) as described above. The TXP-based electronic tag includes a receiver (i.e. 13.56 MHz high frequency receiver), which is responsive to the wake-up signal and in response the TXP identifies itself using the 13.56 MHz frequency. The TXP-based electronic tag also retransmits the identifier or ID number for the electronic tag using the 433 MHz UHF communication channel which is received by the tracking station(s) 20 (Fig. 1). Using the tracking station(s) 20 and the network 30, the control module

40 under software control is then able to process and determine the location of the electronic tag, and thereby the position of the person wearing the tag. In stand-by or sleep mode, the TXP device on the electronic tag draws very little current and under normal operating conditions, the lithium power cell should provide sufficient power for about 9 years.

[0050] The interrogators or readers for the tracking stations 20 in a RFID based system are implemented using ISO 15693 Tag inlay compliant devices or technology. The ISO 15693 compatible interrogators provide for operability with RFID cards or tags, such as the TXP as described above, and RFID tags from different manufacturers, as will be within the understanding of those skilled in the art.

[0051] The present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. Other adaptations and modifications of the invention will be obvious to those skilled in the art. Therefore, the presently discussed embodiments are considered to be illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

WHAT IS CLAIMED IS:

1. A system for providing containment of an infectious disease in a facility, said system comprising:

a plurality of scrutinizers, each of said scrutinizers including a receiver for receiving an identification signal, and further including an output module for outputting a signal in response to said identification signal being received;

a plurality of identification tags, one of said identification tags being worn by each person having entry in the facility, and each of said identification tags including a transmitter for transmitting the identification signal associated with the person wearing said respective identification tag;

said plurality of scrutinizers being located throughout the facility including and including an entrance scrutinizer, an exit scrutinizer, and one or more passageway scrutinizers;

a controller, said controller having an input port for receiving said output signals generated by each of said scrutinizers, and further including a processing module, said processing module having a sub-module for creating a record for each of said persons having entry in the facility, said record including temporal information from one or more of said scrutinizers having detected the identification signal associated with the person.

2. The system as claimed in claim 1, wherein said record further includes positional data, said positional data comprising the location of said scrutinizer having detected the identification signal associated with the person.

3. The system as claimed in claim 1, further including a plurality of apparatus tags, said apparatus tags being attached to selected equipment in the facility, and each of said apparatus tags including a transmitter for transmitting an identification signal associated with said equipment carrying one of said apparatus tags.

4. The system as claimed in claim 3, wherein said processing module includes another sub-module for creating a record for said equipment, said record including temporal information from one or more of said scrutinizers having detected the identification signal associated with said equipment.

5. The system as claimed in claim 2, wherein said transmitter comprises a RFID transponder, and said scrutinizer comprises a RFID interrogator.

6. The system as claimed in claim 5, wherein the output module for said scrutinizer comprises a wireless communication interface operating a communication protocol.

7. The system as claimed in claim 6, wherein said controller comprises a computer system, and said input port comprises a wireless interface, said wireless interface operating a communication protocol compatible with the communication protocol for said wireless communication interface.

8. A method for tracking potential carriers of an infectious disease in a facility, said method comprising the steps of:

assigning a unique identifier to each individual having access to the facility, and providing each of said individuals with a transmitter for transmitting the assigned unique identifier;

detecting transmission of the unique identifiers for said individuals at one or more locations in the facility based on movement of said individuals;

establishing a record for each of said individuals, each of said records including temporal data indicating time and date for detection of the unique identifier for said associated individual;

storing said records and making said records available for retrieval;

identifying one or more of said individuals as the potential carriers based on a disease condition;

retrieving said records associated with each of said identified individuals;

establishing an area of movement for each of said identified individuals, said area of movement being based on said temporal data and said plurality of locations in the facility where the unique identifier was detected.

9. The method as claimed in claim 8, further including the step of identifying any other individuals who where within said areas of movement, said other individuals being identified as other potential carriers.

10. The method as claimed in claim 8, further including the step of initiating an alarm when movement of one or more of said identified individuals is detected beyond a defined area.

11. The method as claimed in claim 9, further including the step of assigning a unique identifier to each of a plurality of apparatus movable in the facility.

12. The method as claimed in claim 11, wherein said step of establishing an area of movement includes identifying any apparatus present in said area of movement, and establishing an area of apparatus movement for said apparatus present.

13. The method as claimed in claim 11, further including the step of identifying any other individuals who where within said areas of apparatus movement, said other individuals being identified as other potential carriers.

14. A system for tracking the movement of persons in a facility as potential carriers of an infectious virus or disease, said system comprising:

a plurality of receivers, each of said receivers having an input for receiving an identification signal, each of the persons in the facility having an associated

identification signal, and each of said receivers including an output for outputting an output signal for each of said identification signals;

a plurality of transmitters, each of the persons wearing one of said transmitters, and each of said transmitters transmitting the identification signal associated with the person;

said plurality of receivers being located throughout the facility;

a controller having an input port for receiving the output signals, and including a component for generating a temporal record for each of the persons in response to the detection of said identification signal of the person by one or more of said receivers.

15. The system as claimed in claim 14, wherein one or more of said transmitters are attached to apparatus in the facility, and each of said transmitters transmits an identification signal associated with said apparatus.

16. The system as claimed in claim 15, wherein said controller includes another component for generating a temporal record for each of said apparatus in response to the detection of the identification signal of said apparatus by one or more of said receivers.

17. The system as claimed in claim 16, wherein said transmitter comprises a RFID transponder, and said receiver comprises a RFID interrogator.

18. The system as claimed in claim 17, wherein the output for said receiver comprises a wireless communication interface operating a communication protocol.

19. The system as claimed in claim 18, wherein said controller comprises a computer system, and said input port comprises a wireless interface, said

wireless interface operating a communication protocol compatible with the communication protocol for said wireless communication interface.

ABSTRACT

A system and method for containing and restricting spread of infectious diseases within hospitals, clinics and other medical facilities by cataloguing and delimiting movement of patients, medical staff, employees, visitors, contractors and other personnel attending or on-site. The system also provides for tracking and cataloguing contaminated medical apparatus, medicine trolleys, food trolleys, medical gas stations, laundry baskets and other mobile or movable medical equipment or facility equipment to prevent spread of the infectious disease or viral entities.

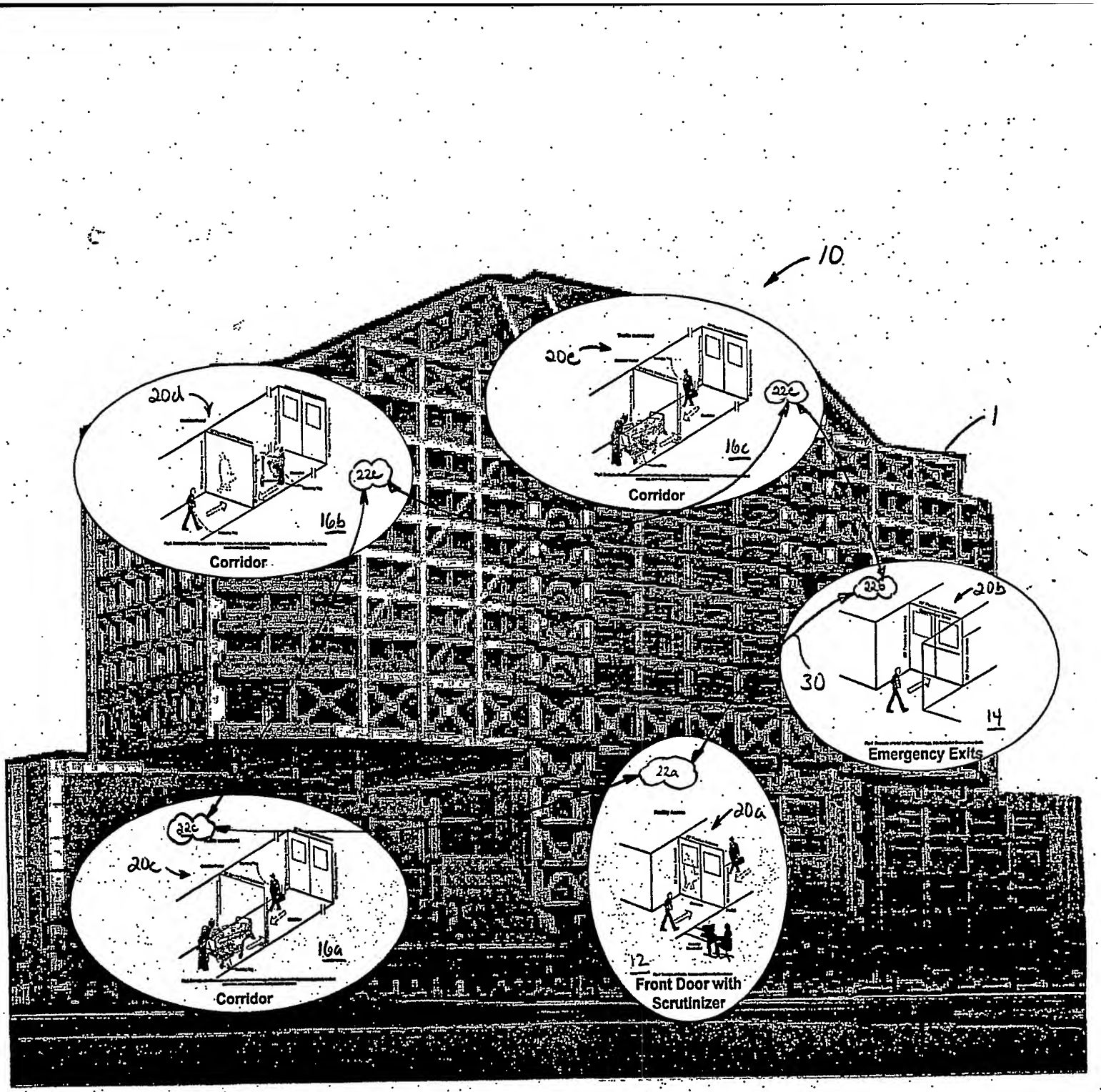

FIG. 1

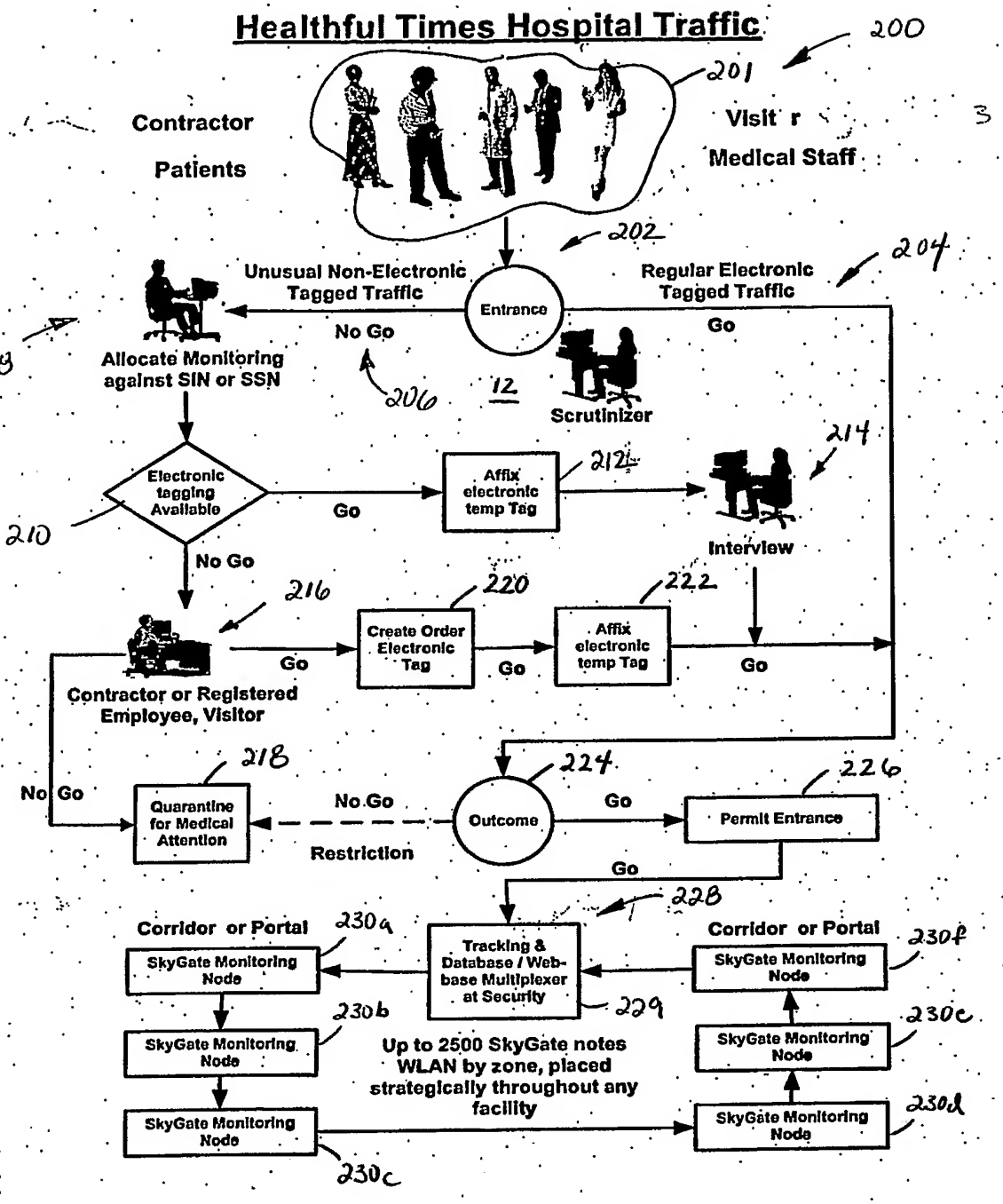

FIG. 2

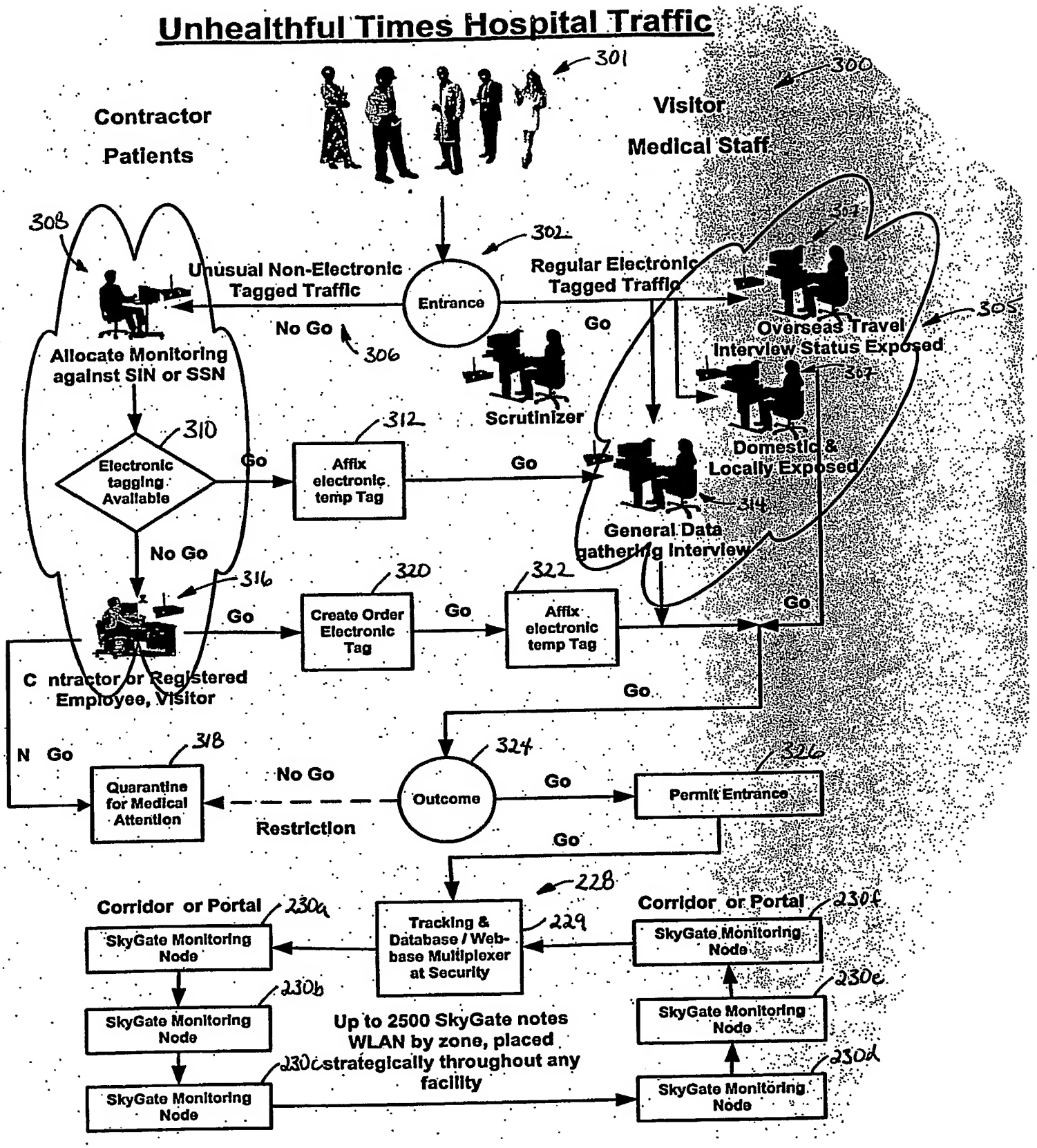

FIG. 3

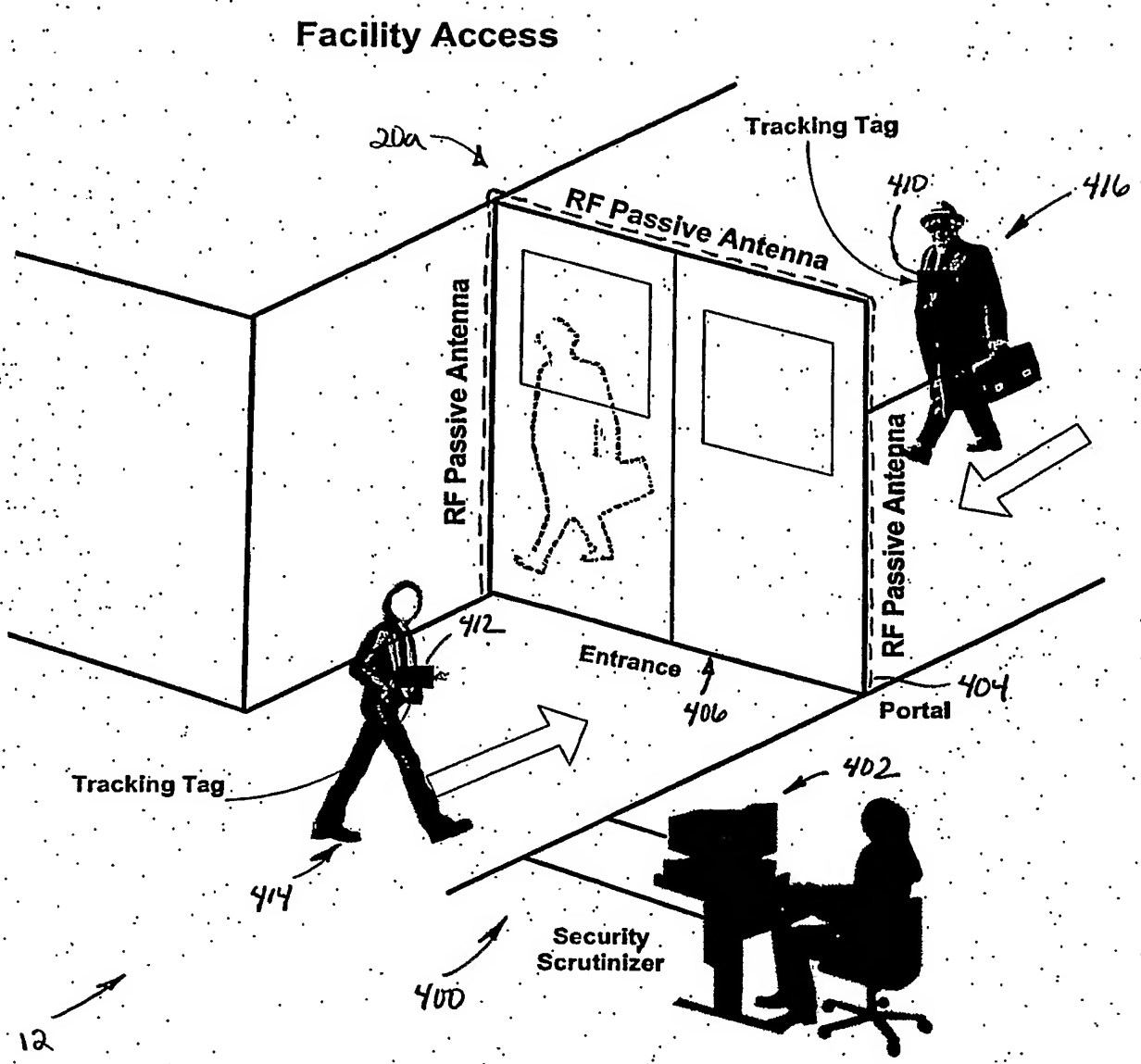

FIG. 4

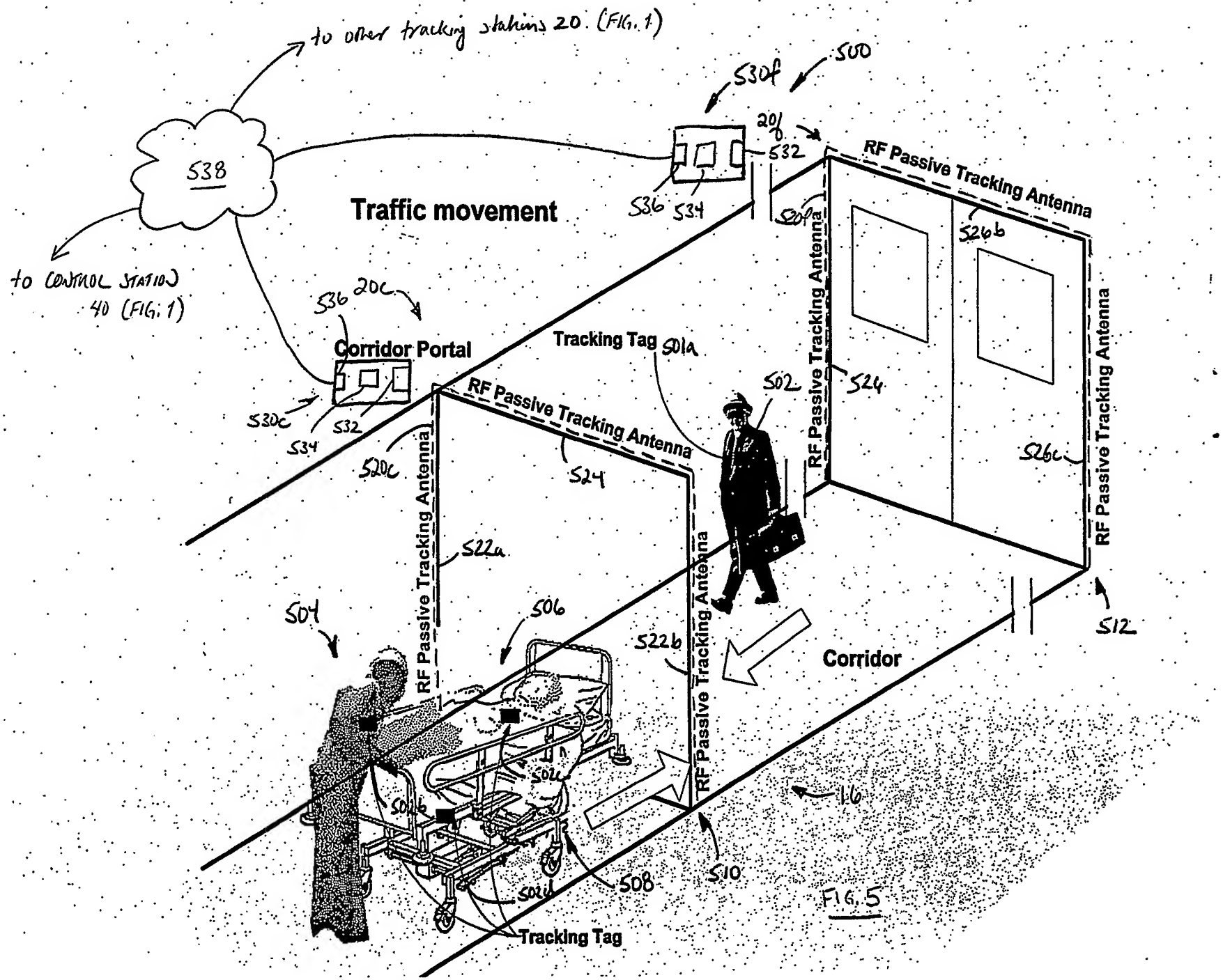

FIG. 5

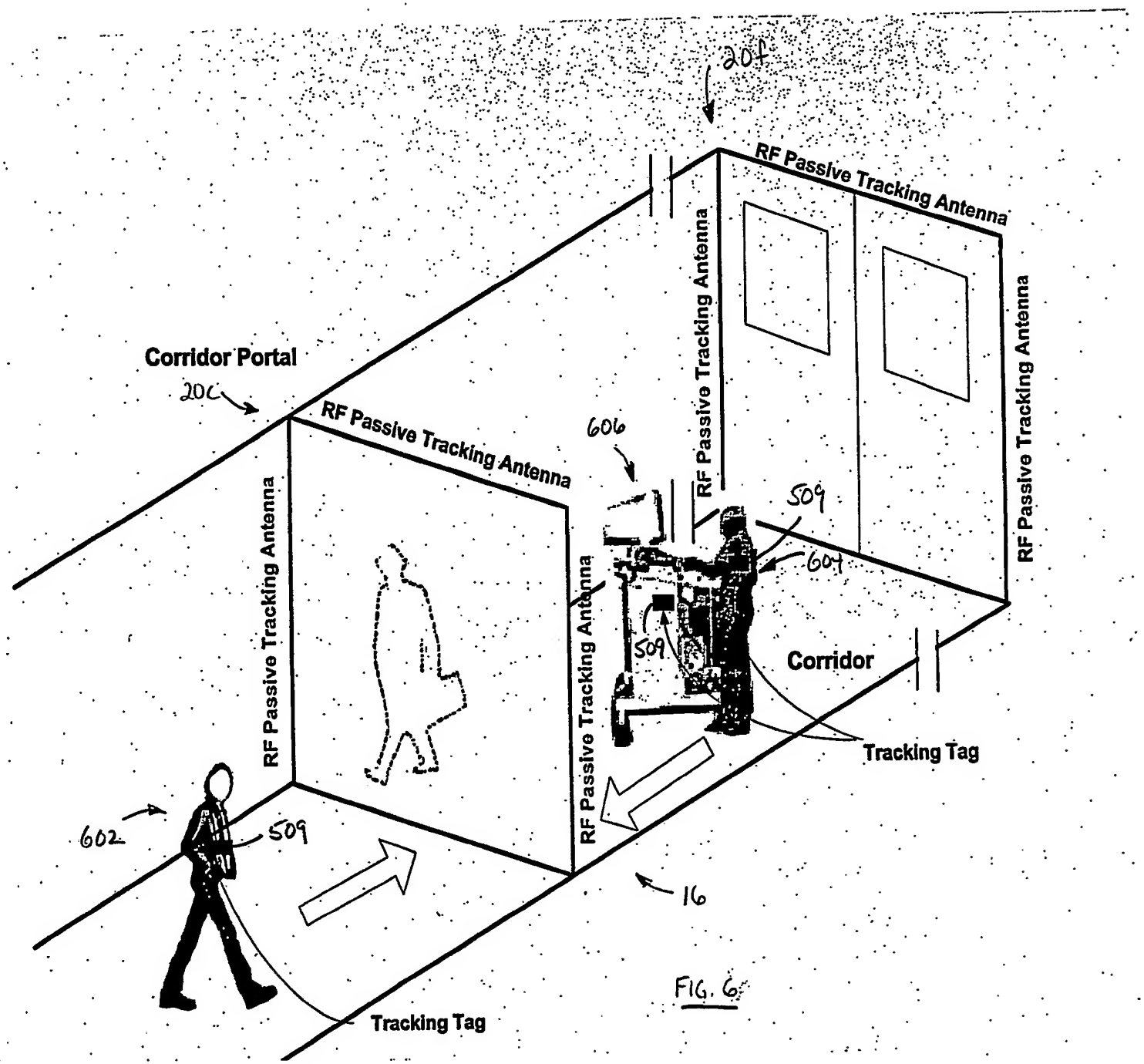

FIG. 6

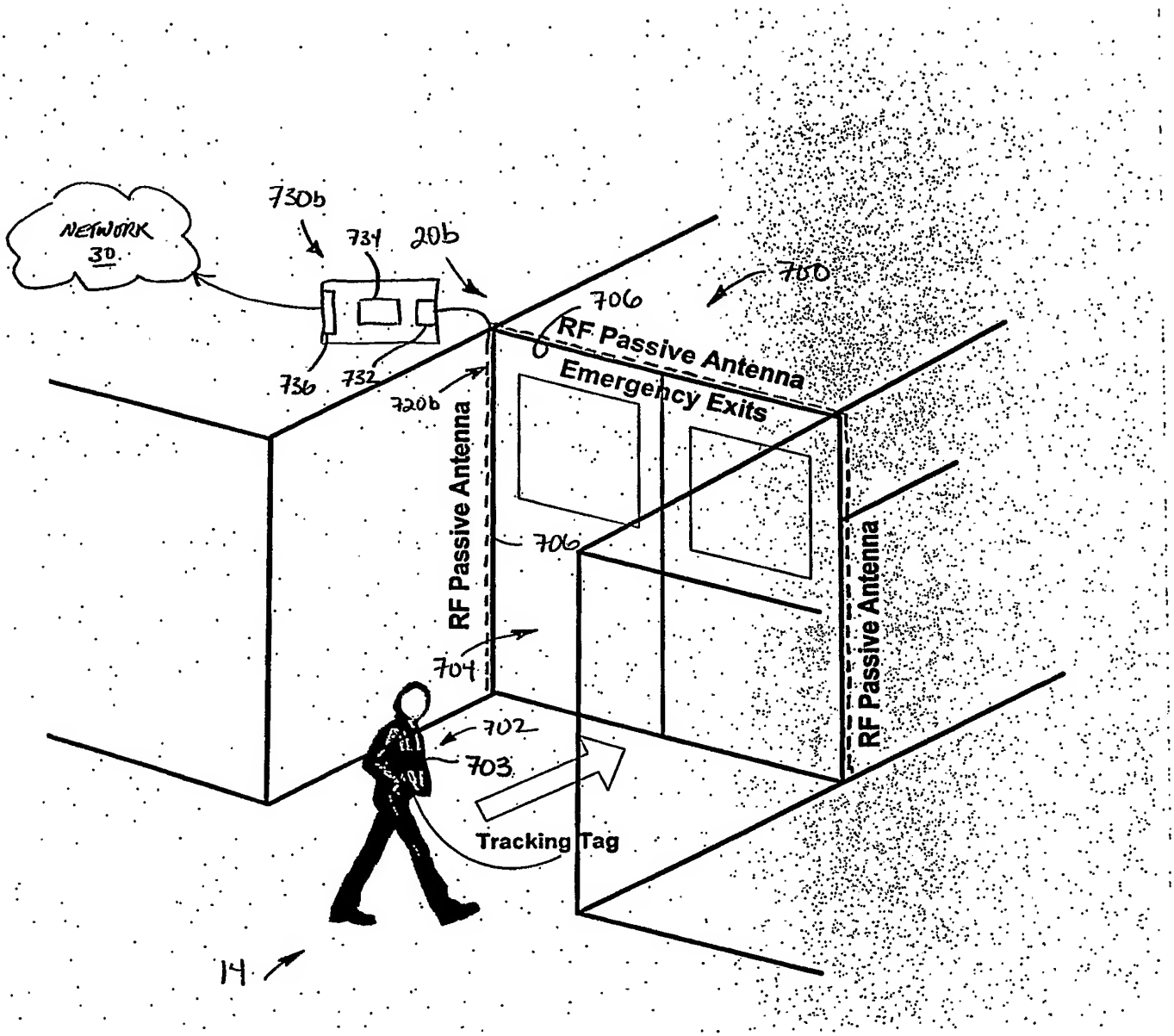

FIG. 7

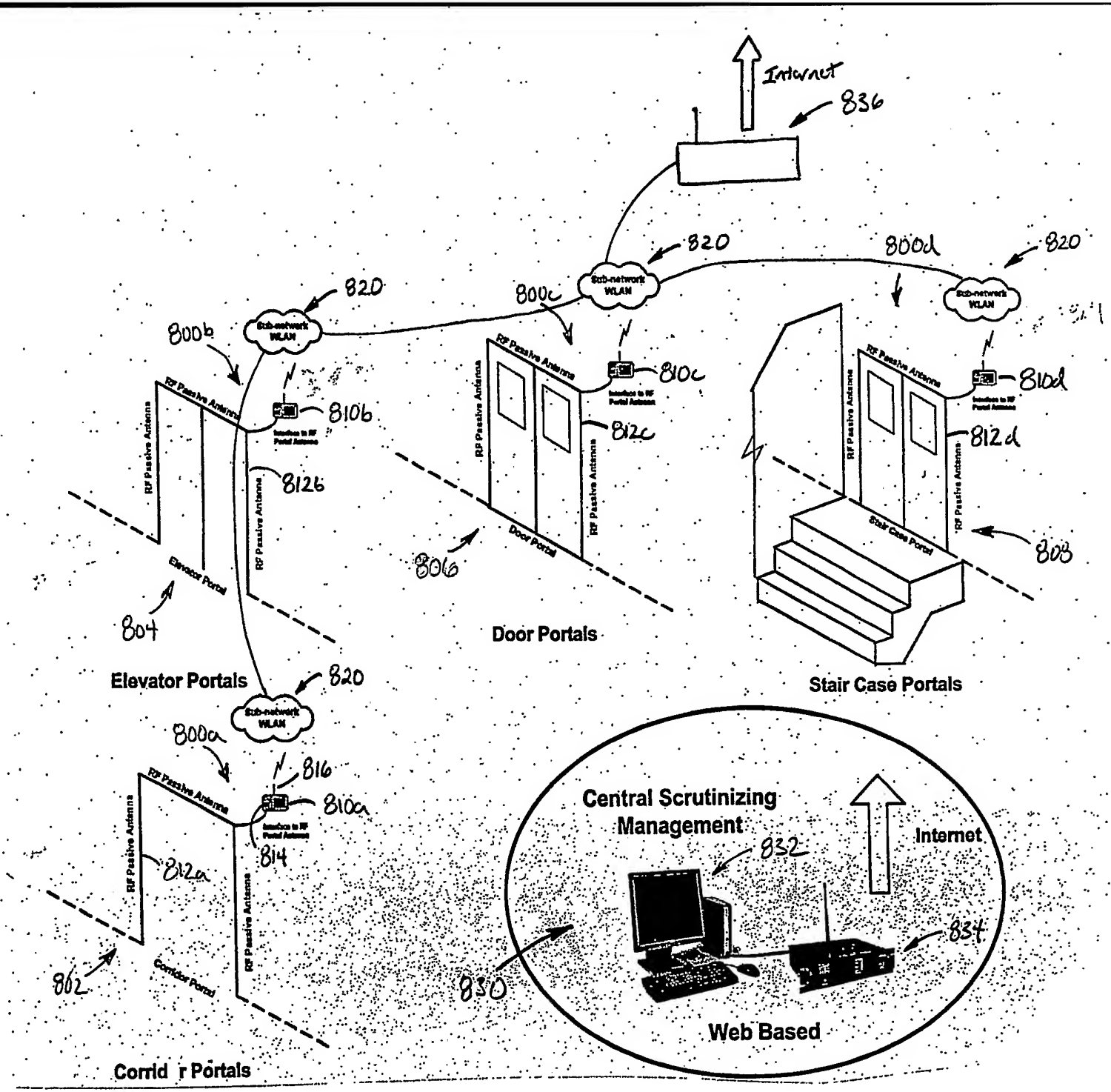

FIG. 8

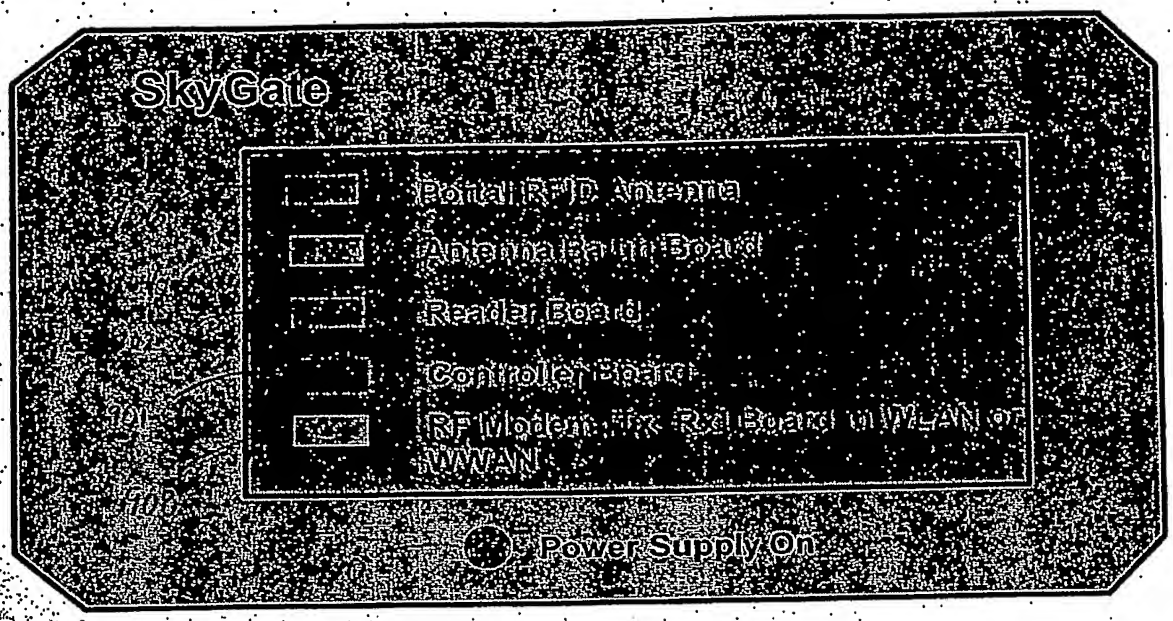

FIG. 9

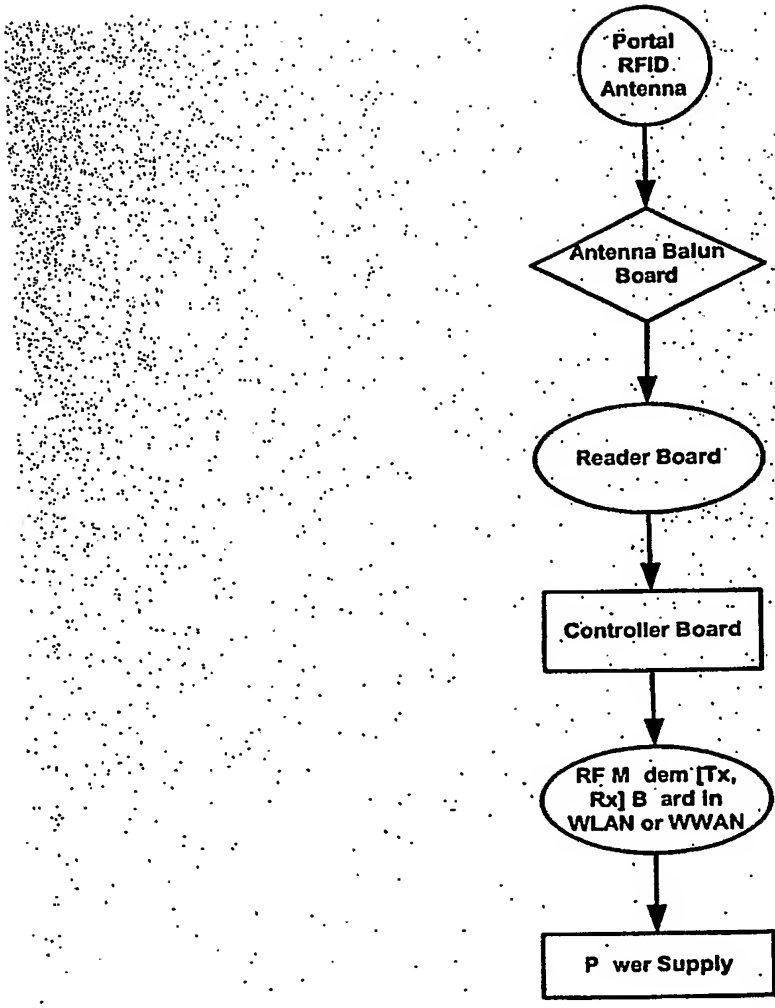

FIG. 10

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